

WHAT IS CLAIMED IS:

1. A light emitting device, comprising:
an array of organic light emitting diodes (OLEDs) emitting a plurality of
5 colors; and
a layer of scattering media above a light emitting surface of the array.
2. The device of claim 1, wherein the device emission appears as white light
to a human observer.
- 10 3. The device of claim 1, wherein the array comprises:
a first set of a plurality of a first color light emitting OLEDs electrically
connected together to the same power source such that each OLED receives the
same power signal at the same time; and
15 a second set of a plurality of a second color light emitting OLEDs
electrically connected together to the same power source such that each OLED
receives the same power signal at the same time.
4. The device of claim 3, further comprising:
20 a third set of a plurality of a third color light emitting OLEDs electrically
connected together to the same power source such that each OLED receives the
same power signal at the same time; and
wherein the first color comprises red, the second color comprises green
and the third color comprises blue.

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5. The device of claim 4, further comprising a power controller which provides a first amount of power to the first set of OLEDs, a second amount of power to the second set of OLEDs and a third amount of power to the third set of OLEDs to obtain a combined device light output having a desired color.

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6. The device of claim 1, wherein the OLED array comprises:
a first set of a plurality of OLEDs emitting a plurality of different colors, electrically connected together to the same power source such that each OLED receives the same power signal at the same time; and

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a second set of a plurality of OLEDs emitting a plurality of different colors, electrically connected together to the same power source such that each OLED receives the same power signal at the same time.

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7. The device of claim 6, wherein:
the plurality of colors comprise red, green and blue colors; and
the red, green and blue light emission from the first set of OLEDs appears as a first white color light, and the red, green and blue light emission from the second set of OLEDs appears as a second white color light different from the first white color light.

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8. The device of claim 7, further comprising a power controller which provides a first amount of power to the first set of OLEDs and a second amount of power to the second set of OLEDs to obtain a device light output having a desired white color.

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9. The device of claim 2, wherein:
each OLED emits light of a first color; and
further comprising a luminescent material over each OLED, which emits light of a second color.

10. The device of claim 9, wherein the OLEDs emits blue light and the luminescent material comprises a phosphor which emits yellow light, such that the OLED appears to emit white light to a human observer.

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11. The device of claim 10, wherein the OLED array comprises:

a first set of OLEDs comprising a plurality of OLEDs covered with a first phosphor which emit white light having a first color temperature; and

10 a second set of OLEDs comprising a plurality of OLEDs covered with a second phosphor which emit white light having a second color temperature different from the first color temperature.

12. The device of claim 11, wherein:

15 the first set of OLEDs are electrically connected together to a power source such that each OLED receives the same power signal at the same time; and the second set of OLEDs are electrically connected together to a power source such that each OLED receives the same power signal at the same time.

13. The device of claim 12, further comprising a power controller which provides a first amount of power to the first set of OLEDs and a second amount of power to the second set of OLEDs to obtain a device white light output having a desired color temperature.

14. The device of claim 1, wherein the layer of scattering media comprises particles which scatter but do not appreciably absorb visible light emitted by the OLEDs.

15. The device of claim 14, wherein the scattering particles comprise titania, alumina or zinc oxide particles located above and between the OLEDs.

16. The device of claim 15, wherein the scattering particles comprise titania particles coated with an alumino-silicate glass having a mean particle size of about 300 nm.

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17. A light emitting device, comprising:

(a) an array of OLEDs comprising:

(i) a first set of a plurality of OLEDs electrically connected together to the same power source such that each OLED receives the same

10 power signal at the same time, the first set of OLEDs emit light of a first color; and

(ii) a second set of a plurality of OLEDs electrically connected together to the same power source such that each OLED receives the same power signal at the same time, the second set of OLEDs
15 emit light of a second color different than the first color; and

(b) a power controller which provides a first amount of power to the first set of OLEDs and a second amount of power to the second set of OLEDs to obtain a device light output having a desired color.

20 18. The device of claim 17, wherein the controller provides power to each set of OLEDs to obtain a device light output having a desired white color.

19. The device of claim 18, wherein:

the first set of OLEDs comprises a plurality of red light emitting OLEDs;

25 the second set of OLEDs comprises a plurality of green light emitting OLEDs; and

further comprising a third set of a plurality of blue light emitting OLEDs electrically connected together to the same power source such that each OLED receives the same power signal at the same time.

20. The device of claim 18, wherein:
the first set of OLEDs comprises a plurality of red, green and blue light emitting OLEDs;
5 the second set of OLEDs comprises a second set of a plurality of red, green and blue light emitting OLEDs; and
the red, green and blue light emission from the first set of OLEDs appears as a first white color light, and the red, green and blue light emission from the second set of OLEDs appears as a second white color light different from the first
10 white color light.
21. The device of claim 18, wherein the OLEDs comprise blue light emitting OLEDs covered with a ADE:Ce³⁺ phosphor, where A comprises at least one of Y or Gd, D comprises at least one of Al, Ga or Sc and E comprises oxygen, and
15 which emits yellow light, such that the OLEDs appear to emit white light to a human observer.
22. The device of claim 21, wherein:
the first set of OLEDs contains the ADE:Ce³⁺ phosphor having a first
20 composition, the first set of OLEDs emitting white light having a first color temperature;
a second set of OLEDs contains the ADE:Ce³⁺ phosphor having a second composition, the second set of OLEDs emitting white light having a second color temperature different from the first color temperature; and
25 the desired light output having a desired white color comprises a light output having a desired color temperature.
23. The device of claim 17, further comprising:

(c) a layer of scattering media above a light emitting surface of the OLED array.

24. The device of claim 23, wherein the layer of scattering media comprises particles which scatter but do not appreciably absorb visible light emitted by the OLEDs.

25. The device of claim 24, wherein the scattering particles comprise titania, alumina or zinc oxide particles located above and between the OLEDs.

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26. The device of claim 24, wherein the plurality of separate OLEDs are attached to a common mounting substrate.

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27. The device of claim 26, wherein each OLED comprises:
a transparent substrate below the layer of scattering media;
a transparent electrode below the transparent substrate;
an organic polymer or molecular light emitting layer below the transparent electrode;

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a metal electrode below the light emitting layer;
a sealing member below the metal electrode;
metal device contacts contacting the transparent and metal electrodes, having portions located below the sealing member; and
further comprising

an adhesive layer on the mounting substrate supporting the array of OLEDs, such that the metal device contacts of each OLED are mounted over the adhesive layer; and
electrical contacts contacting the metal device contacts through the mounting substrate.

28. The device of claim 27, further comprising a shaped material, which comprises the transparent substrate or a transparent material attached to the transparent substrate, and which contains:
- (i) nanoparticles having a size of less than 100 nm which adjust an index of refraction of the output coupler such that it is equal or close to the index of refraction of the organic light emitting diode;
 - (ii) and a dimpled light emitting surface.
29. A method of generating white light, comprising:
- providing a first power signal having a first magnitude to a first set of plurality of OLEDs, such that the first set of OLEDs emit light of a first color;
 - providing a second power signal having a second magnitude to a second set of plurality of OLEDs, such that the second set of OLEDs emit light of a second color different than the first color; and
 - passing the light of the first color and the second color through a scattering medium to mix the light of the first and second colors such that the mixed light appears white to a human observer.
30. The method of claim 29, wherein the steps of providing the first and second power signals comprises providing a first amount of power to the first set of OLEDs and a second amount of power to the second set of OLEDs to obtain a device light output having a desired color temperature.
31. The method of claim 30, further comprising controlling the amount of power provided to the first and second sets of OLEDs to generate white light having the desired color temperature.
32. The method of claim 29, wherein:
the step of emitting the first color light comprises emitting red light;

the step of emitting the second color light comprises emitting green light;
and

further comprising emitting blue light from a third set of OLEDs and
passing the blue light through the scattering medium to mix the red, green and
5 blue light, such that the mixed light appears white to a human observer.

33. The method of claim 29, wherein:

the step of emitting the first color light comprises emitting white light
having a first color temperature;

10 the step of emitting the second color light comprises emitting white light
having a second color temperature; and

the mixed light comprises white light having a color temperature value
between the first and second color temperature values.

15 34. A method of making a light emitting device, comprising:

forming an array of OLEDs;

electrically connecting a first set of OLEDs which emit light of a first color
to the same power source;

20 electrically connecting a second set of OLEDs which emit light of a
different second color to the same power source; and

forming a layer of scattering medium over the array of OLEDs.

35. The method of claim 34, further comprising mounting the array of
individual OLEDs on a common mounting substrate.

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36. The method of claim 35, wherein the step of forming each OLED
comprises:

forming a transparent electrode over a first substrate;

forming a polymer or molecular organic light emitting layer over the transparent electrode;

forming a metal electrode over the organic light emitting layer;

forming a sealing member above the metal electrode;

5 removing a portion of the organic light emitting layer above the transparent electrode to expose a first portion of a top surface of the transparent electrode;

forming a first metal device contact over the sealing member, which contacts the first portion of the top surface of the transparent electrode;

forming a second metal device contact over the sealing member, which
10 contacts a top surface of the metal electrode; and
wherein the step of forming the array comprises:

forming an adhesive layer over the mounting substrate;

attaching each OLED over the adhesive layer;

forming electrical contacts through the mounting substrate and the
15 adhesive layer which contact the first and second device contacts; and

forming the layer of scattering media over the first substrate.

37. The method of claim 35, wherein:

the first set of OLEDs which emit light of a first color comprises a set of
20 red emitting OLEDs;

the second set of OLEDs which emit light of a second color comprises a set of green emitting OLEDs; and

further comprising electrically connecting a third set of OLEDs which emit
blue light to the same power source.

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38. The method of claim 35, wherein:

the first set of OLEDs which emit light of a first color comprises a set of red, green and blue light emitting OLEDs whose output appears as white light of a first color;

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the second set of OLEDs which emit light of a first color comprises a set of red, green and blue light emitting OLEDs whose output appears as white light of a different second color.

5 39. The method of claim 35, wherein:

the first set of OLEDs which emit light of a first color comprises a set of blue light emitting OLEDs and a first phosphor whose combined output appears as white light having a first color temperature; and

10 the second set of OLEDs which emit light of a second color comprises a set of blue light emitting OLEDs and a second phosphor whose combined output appears as white light having second color temperature different from the first color temperature.